AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Vol. 23 NOVEMBER, 1946 No. 11

VISUAL STANDARDS AND JOB REQUIREMENTS*

Joseph Tiffin and W. F. Long†
Purdue University
Lafayette, Indiana

For many years, industry has given some form of vision test to new employees. Often a distance acuity test is the only one that has been used. This has been due partly to the fact that industrial compensation for eye injuries is traditionally paid in terms of loss of distance acuity, and partly to the implicit assumption that "good vision" is indicated primarily by a distance acuity test.

Recent findings of an extensive research program at Purdue University have shown that several additional visual skills are necessary for adequate performance on many jobs. This work has led to the development and application of a series of vision tests designed specifically for industrial use. This work has involved the collaboration of Purdue University, the Bausch and Lomb Optical Company, committees of the optometric and medical professions, and a group of industrial plants in which the tests were validated.

Two of the important results of this program are:

(1) the development of the "Ortho-Rater," an instrument designed to be used for the convenient and reliable visual classification of employees;

(2) the gathering and analysis of a vast amount of data demonstrating the relationship between visual skills and industrial production and safety of workers.

Early in this research program it was found that certain aspects of visual performance (including other aspects besides visual acuity at twenty feet) are important for satisfactory performance on a variety of

*Submitted on August 28, 1946 for publication in the November, 1946, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERIMAN ACADEMY OF OPTOMETRY.

†Division of Applied Psychology.

industrial jobs. Figure 1 shows the relation between job performance of 225 radio tube assemblers and their *near visual acuity* which is the ability to see progressively smaller detail at a distance of 13 inches from the eyes. On this figure, near-point acuity is plotted on the base line,

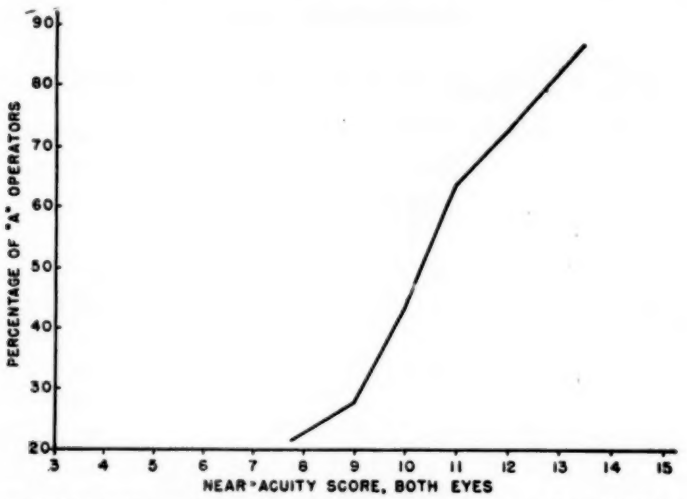

Figure 1. Relation between job performance and near visual acuity of 225 radio tube assemblers.

low at left and high at right, while the percentage of satisfactory operators is plotted on the vertical axis. Near acuity scores for this group of workers ranged from seven to thirteen, the higher score representing ability to see smaller detail. The job performance of these workers was evaluated by their supervisors as "quite satisfactory" and "not entirely satisfactory." In the total group, 53% were rated satisfactory. The curve in Figure I shows the different percentages of "satisfactory" workers (designated as "A" operators) among those scoring at different levels on the near acuity test. Among those scoring 8 or less, only 22% were satisfactory; among those scoring 13 or better, 85% were satisfactory. The higher the near acuity score, the greater the percentage of satisfactory workers, and the greater the likelihood of any one worker being satisfactory. Among applicants selected in the same manner as present employees were selected, those with better near acuity will more consistently become better workers; and if applicants with poor near acuity were not assigned to this particular type of work, the average efficiency of workers on this job would be increased. Good near acuity is one requirement for maximum success on this job and also on many

other jobs that require precise manipulation of small parts at a close distance, and others that involve visual inspection.

Figue 2 shows the relation between near visual acuity and earnings of workers on another near-point job. In this figure, 72 electric

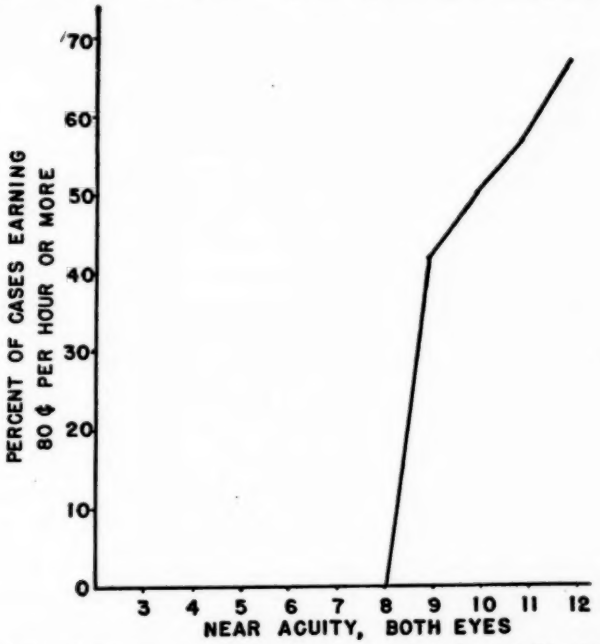

Figure 2. Relation between earnings and near visual acuity of 72 electric solderers.

solderers are classified along the base line according to their near acuity. The proportion of each sub-group who earned 80 cents an hour or more is indicated by the height of the line above the base line at that place. Of those scoring 7 or 8, none were earning as much as 80 cents per hour. The higher the operator's score on the test, the larger the proportion of high production operators, which means that the chances of success are more favorable for those who score highest on the test.

Figure 3 shows a markedly different situation when production ratings of the same 225 radio tube assemblers considered in Figure 1 are plotted against *distance* visual acuity (at the optical equivalent of 26 feet). It will be noted in this case that there is no systematic relationship between test scores and efficiency on the job. The proportion of employees rated "A" (satisfactory) among each sub-group is indicated by the height of the line above the base line at successive score points. In spite of several rises and falls, this curve shows no consistent

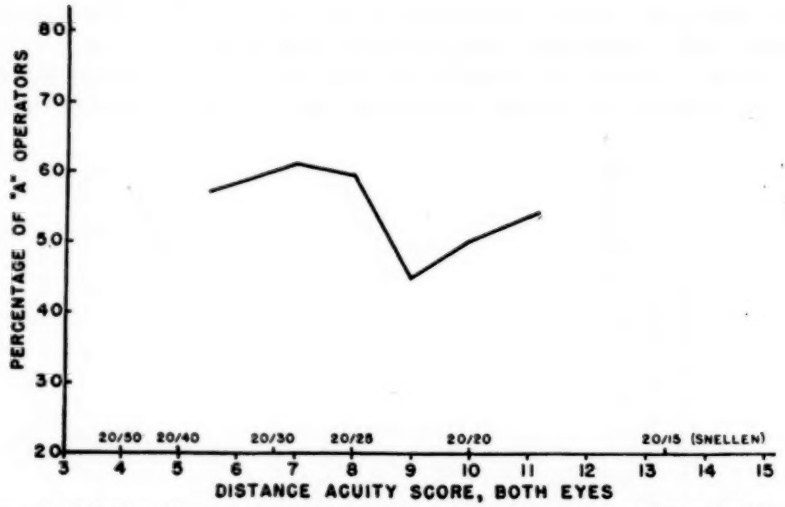

Figure 3. Relation between job performance and distance visual acuity of 225 radio tube assemblers.

trend either up or down with higher scores on this test. Employees with low scores on this test are rated "A" as frequently as those with high test scores. Distance acuity, therefore, is not related to job performance, and a minimum requirement on distance acuity for this job would not result in any improvement in job performance. Here is rather convincing evidence that "good vision" for this job is something other than good vision at 26 feet.

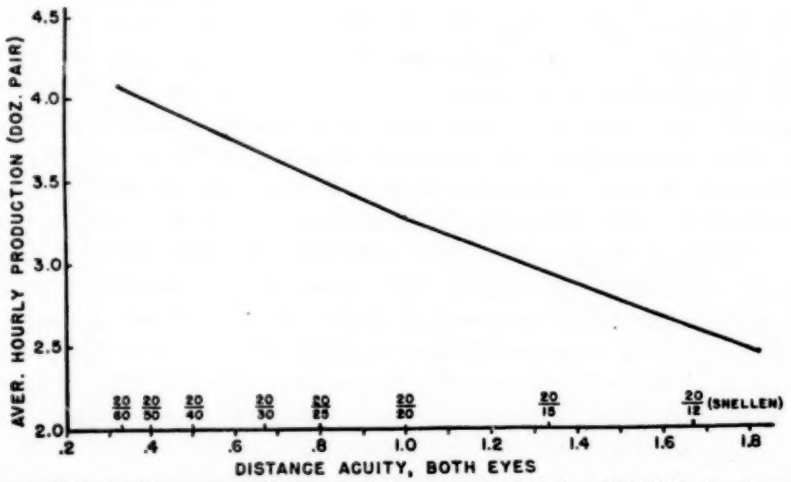

Figure 4. Relation between production and distance visual acuity of 199 hosiery loopers.

Sometimes a test shows a negative or reverse relation with job performance, as is illustrated in Figure 4. This chart shows the relation between distance visual acuity and average hourly production of 199 hosiery loopers who had a year or more of experience on the job. Their distance acuity is plotted along the base line, the left of the chart representing poor distance acuity and the right representing keen distance acuity. The Snellen notation of visual acuity is indicated above the base line. It will be noted that loopers with the poorest distance acuity produced on the average more than four dozen pairs per hour, while those with the keenest distance acuity processed on the average only two and a half dozen pairs per hour. The better their distance acuity, the lower their production. This negative relation between job performance and distance acuity suggests that "good vision" measured in terms of distance acuity alone would not be suitable for this job. The explanation for this negative relation probably lies in the fact that the looper's work is done at only eight to ten inches from the eyes and those workers whose eyes are best adapted for seeing fine detail at a great distance are generally not the ones whose eyes are best adapted for continuous critical seeing at a very close distance.

The preceding demonstrations of the relation between two measures of a worker's visual acuity and production efficiency suggest consideration of the relation between the two measures themselves, that is, how accurately does a distance acuity test indicate the worker's near acuity? This question was investigated by testing two groups of employees with precise acuity tests at both distance and near-point (13 inches), with glasses as customarily worn, plotting the results in the form of a standard scattergram and computing the coefficient of correlation between the two test scores. The scattergram for 312 employees under 30 years of age is reproduced in Table 1. In this table, it will be noted that the scores tend to pile up on quadrants at the upper right, lower left, and to some extent, at the upper left. There are practically no entries in the lower right quadrant. This means that an employee falling in the age range under 30 who tests high in distance visual acuity is very likely to be fairly high in near acuity, while one testing low in distance acuity is not so certain to be low in near visual acuity. In other words, among employees in this relatively young age group, if one has keen distance acuity, it is reasonably safe to assume that he will be satisfactory in near acuity, but if he tests low in distance acuity, one cannot with equal assurance conclude that he will be low in near acuity. An employment policy that excludes from consideration all em-

ployees who are low in distance acuity will automatically exclude a considerable proportion of employees whose near acuity is average or even above average.

TABLE 1

SCATTERGRAM SHOWING THE RELATION BETWEEN NEAR AND DISTANCE VISUAL ACUITY, BOTH EYES FOR 312 EMPLOYEES UNDER AGE 30.

$r = .77$

Near Acuity Score	Distance Acuity Score													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
13	..	..	..	..	..	..	..	..	..	..	1	1	..	..
12	..	..	..	..	..	..	..	..	1	1	3	5	1	1
11	..	..	..	..	..	..	2	..	1	7	5	4	6	..
10	..	1	..	..	..	..	..	..	4	14	17	6	..	..
9	..	..	1	2	..	..	3	8	22	38	13	6	3	..
8	1	..	..	..	1	5	2	18	19	10	1	..	..	..
7	..	1	1	1	..	..	2	8	2	2	..	..	..	..
6	2	3	..	2	2	1	4	5	2	..	1	..	..	..
5	..	..	..	1	..	..	..	..	1	..	..	..	..	..
4	..	2	..	..	1	..	..	..	..	..	..	..	..	..
3	..	..	2	..	..	..	..	..	..	..	..	..	..	..
2	1	1	..	2	..	1	..	..	..	1	..	..	..	..
1	4	2	..	1	1	..	..	..	..	1	..	..	..	..
0	11	2	1	..	..	..	..	..	2	..	1	..	..	..

Table 2 shows a similar scattergram for 144 employees over 40 years of age. In this scattergram, the entries fall mainly in the quadrants at the upper right, lower left, and lower right, with only a very few in the upper left quadrant. This means that among older employees, those testing high in distance acuity may be either high or low in near acuity, but if they test low in distance acuity they are almost certain to be low in near acuity as well. In other words, in working with older applicants, those who are excluded because they test low in distance acuity will tend in general to have poor near acuity, but the hiring of those with satisfactory distance acuity will be no guarantee that the employees will have satisfactory near acuity.

It should be emphasized that the statements just made represent

tendencies only. In no individual case can one be sure of an accurate prediction of near acuity from a measurement of distance acuity, or vice versa, especially among older employees. The correlation resulting from the scattergram in Table 1 is .77* and that from the scattergram in Table 2 is only .48*. While this latter correlation for the older group permits some accuracy in predicting group differences in near acuity on the basis of group averages on distance acuity, the average error of individual predictions would be 77 per cent as great as by sheer guessing. Knowing only the age of a worker, and not his distance acuity, his near acuity could be predicted with an average error 82 per cent as great as by sheer guess. Near acuity of older workmen can therefore be predicted from their age alone nearly as accurately as from their distance acuity.

Thus it can be seen that a distance acuity test is not at all a satisfactory basis for predicting ability to see clearly at a close distance. Even though employees with high distance acuity may have higher average near acuity (with many individual exceptions) than those with low distance acuity, it would certainly seem unwise to depend on a distance acuity test for placing employees in jobs requiring close vision, when a near acuity test will indicate directly their ability to see clearly at close distance.

Another area where visual skills are important is in accident prevention, or the detection of accident-prone workers. Distance visual acuity alone is as inefficient in this area as a means of selecting superior

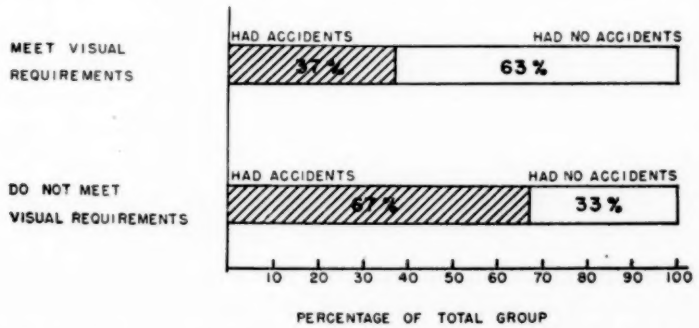

Figure 5. Relation between incidence of serious accidents and visual skills among 104 paper machine operators.

*Perfect correlation between two measures is indicated by +1.00. A correlation of .77 is such that individual differences on one measure account for 50% (.77 squared) of the individual differences on the other measure. A correlation of .48 is such that individual differences on one measure account for 23% (.48 squared) of the individual differences on the other measure.

workers as it was demonstrated to be in relation to production. Figure 5* shows the relation between visual performance and incidence of serious accidents among 104 paper machine operators. It can be seen that those workers who met the visual standards set up on the basis of a comprehensive study of accidents had only slightly more than half as many accidents as those who did not meet the visual standards. This would indicate that the hiring of workers without regard to their visual

TABLE 2

SCATTERGRAM SHOWING THE RELATION BETWEEN NEAR AND DISTANCE VISUAL ACUITY, BOTH EYES FOR 144 EMPLOYEES OVER AGE 40.

$r = .48$

Near Acuity Score	Distance Acuity Score												
	0	1	2	3	4	5	6	7	8	9	10	11	12
12	..	..	..	..	..	..	..	..	..	..	..	..	1
11	..	..	..	..	..	..	..	..	..	1	..	..	..
10	..	..	..	..	..	..	..	1	2	2	1	1	..
9	..	..	..	..	..	..	..	..	2	6	4	1	..
8	..	1	1	..	1	..	1	7	3	2	12	2	..
7	1	..	..	..	..	..	..	5	6	3	3	..	..
6	..	..	..	..	1	1	2	6	8	3	4	..	..
5	..	..	..	..	1	..	1	3	2	1	..	..	..
4	..	1	..	..	1	1	1	3	2	..	1	..	..
3	..	1	..	..	..	..	..	..	1	1	..	..	..
2	..	1	..	1	..	1	..	1	2	2	..	..	..
1	..	1	..	1	1	..	1	1	1	1	..	..	..
0	2	1	2	..	1	..	2	..	1	3	1	..	..

skills is almost certain to be followed by a poorer safety record than could easily be obtained if certain critical visual test scores were made one of the requirements for employment. This does not mean that all who do not meet these standards are unemployable because most inadequate visual skills can be remedied by adequate professional attention.

Consideration of the relations between different visual skills and

*Wirt, S. Edgar & Leedke, Hazel H., *Skillful Eyes Prevent Accidents.* Annual News Letter—Industrial Nursing Section, National Safety Council, November 1945.

production or safety makes it evident that only those visual requirements that are actually related to worker efficiency on the job will improve the safety and production records in a plant. Valid visual requirements must be determined by comparing individual tests of vision with the available criteria of success on *each* job considered. The visual characteristics of successful experienced workers compared with the visual characteristics of unsuccessful or inexperienced workers are the factual basis for determining visual standards. Once these standards have been established for a particular job, placement of employees on this job should be in terms of their performance on the tests used in determining the acceptable standards.

The visual skills and skill tests that have proved most universally useful and adaptable to industrial situations have been carefully selected, developed, and validated as a part of the long term research program mentioned previously which has been under way for a number of years at Purdue University. These tests are incorporated in the Bausch and Lomb Occupational Vision Tests given with the Ortho-Rater, a precision instrument for the rapid and accurate classification of visual skills of industrial employees and applicants. The tests included are:

At the optical equivalent of twenty-six feet

1. Vertical phoria,
2. Lateral phoria,
3. Acuity, both eyes,
4. Acuity, right eye,
5. Acuity, left eye,
6. Depth perception,
7. Color discrimination.

At the optical equivalent of thirteen inches

1. Acuity, both eyes,
2. Acuity, right eye,
3. Acuity, left eye,
4. Vertical phoria,
5. Lateral phoria.

The visual skills of any employee, as tested and recorded according to specifications, show a pattern of visual performance. Figure 6 is an example of one person's "Visual Performance Profile" of scores on the Ortho-Rater tests. His performance on each test is indicated by a circle around a number on each appropriate line. The chain of these circles represents this person's pattern of visual skills.

The visual requirements for better than average success on any industrial job likewise form a pattern. Such a pattern is determined by studying each visual skill separately in relation to performance on a particular job. If better and poorer operators tend to be different on any of the tests, that is, if the better operators are found predominantly

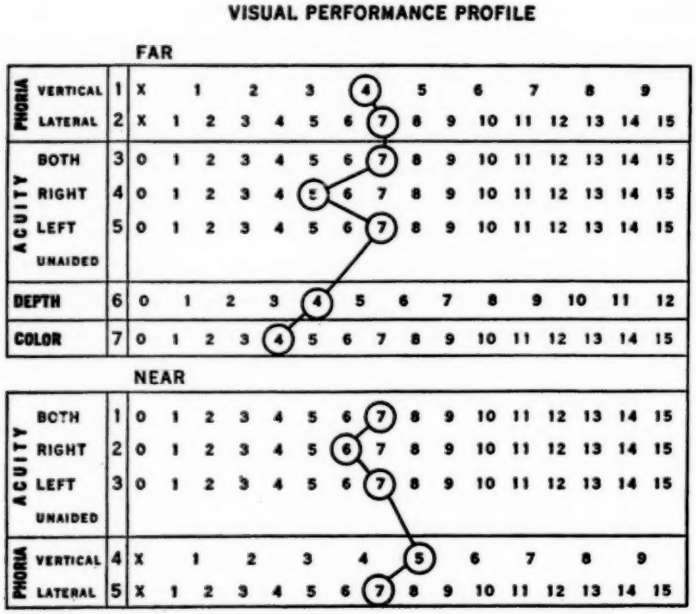

Figure 6. Visual performance profile of an employee plotted from test results obtained with the Bausch and Lomb Ortho-Rater.

among those scoring in a certain range on the test, then the visual characteristic being measured is related to success on the job. It is thus possible to determine what range of scores on each test is predictive of the best chances of success on the job.

In Figure 7 two different job patterns of desirable skills are shown which were determined on the basis of such factual evidence. It will be noted that lathe operators who are most successful meet certain minimum levels of visual skill measured at both far and near distances. The lower pattern shows that for loaders and push truck operators only far vision tests were found to differentiate between above and below average workers.

The profile in Figure 8 demonstrates the danger to the unwary of attaching too much significance to job titles. Both profiles give the patterns of visual skills required for better than average producers on drill presses as determined by analysis of the visual characteristics of operators actually on those jobs. The differences in the patterns can be traced to actual differences in the jobs. The job for which the upper profile in Figure 8 was constructed is such that virtually all the operator is required to do is to place a piece of stock in a jig and pull the

feed handle of the drill, while the operator on the job for which the lower profile was constructed has to perform tasks which are more complicated and demanding of visual skills.

Figure 9 demonstrates the use of job profile patterns in deter-

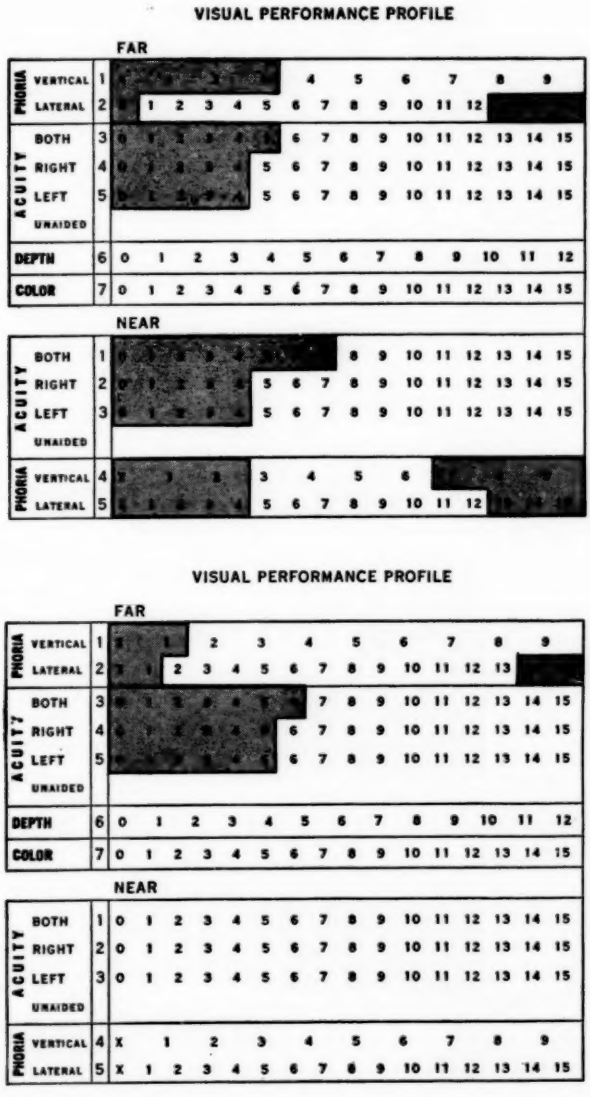

Figure 7. Pattern of desirable skills for two different jobs: upper pattern, lathe operator; lower pattern, loaders and push truck operators.

mining whether or not an applicant has desirable visual characteristics for two different jobs. The visual performance profile given in Figure 6 has been superimposed on the job profiles for a drill press operator and for a milling. machine operator. Examination of this figure will

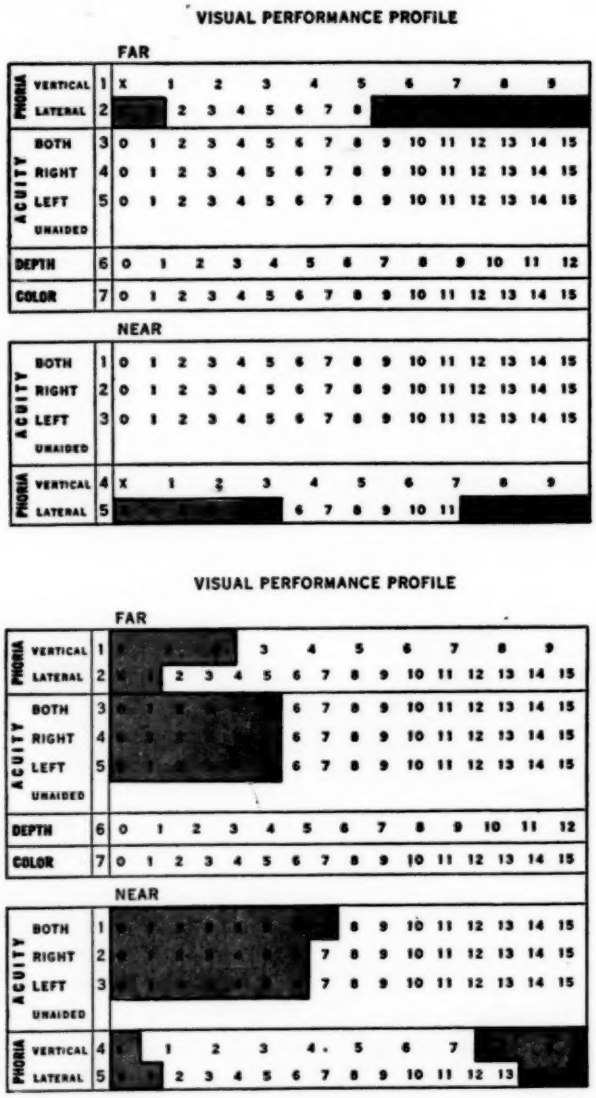

Figure 8. Pattern of desirable visual skills for two different jobs: upper pattern, drill press operator aided by jigs; lower pattern, drill press operator unaided by jigs.

show that this person has desirable visual skills for the job of drill press operator, but falls within the undesirable area in three of the far vision tests and two of the near vision tests on the desirable skills pattern of the milling machine operator. Thus is demonstrated the fact

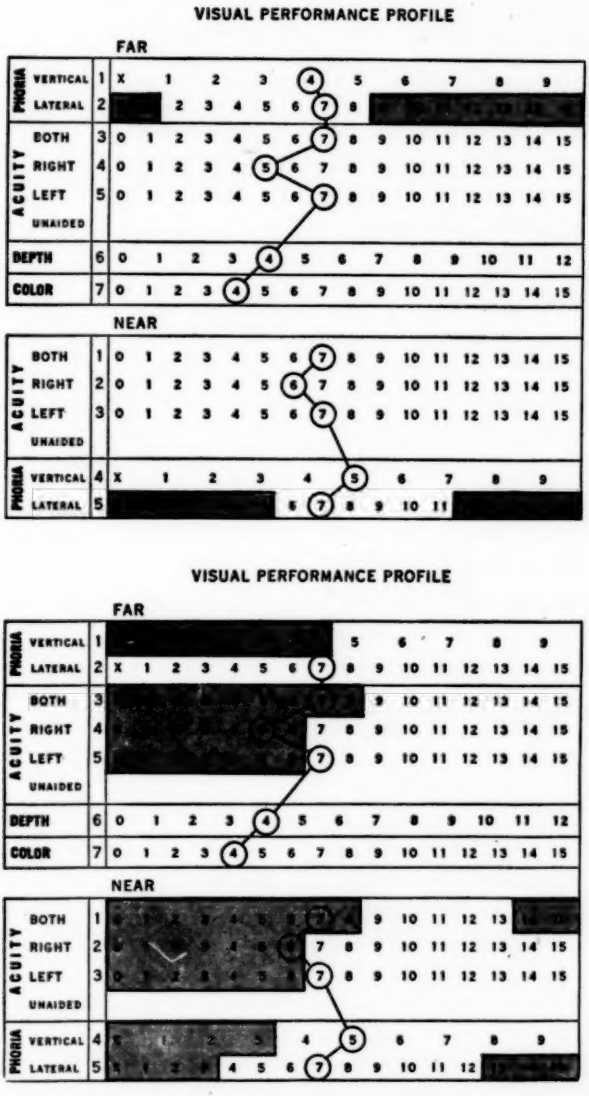

Figure 9. Demonstrating the use of job profile patterns in determining visual fitness of an applicant: upper pattern, applicant has necessary visual skills for drill press operator; lower pattern, applicant does not have necessary skills for milling machine operator.

that an individual may be well qualified visually for one type of industrial job, and poorly qualified visually for another.

The preceding discussion is intended to point out some of the possibilities for improved placement of workers on jobs which will contribute to substantially better industrial production and safety records.

Even more important from the point of view of the ophthalmic professions is that this program results immediately in the identification of those employees who are working under a visual handicap *in terms of the visual demands of their particular job*. When such employees are specifically identified and encouraged to obtain professional help, the advantages of the visual program to both management and employees becomes apparent.

VISUAL TRAINING*

Marguerite Thoma Eberl†
Milwaukee, Wisconsin

The objective of this paper is to present an over view of the clinical subject of orthoptics or visual training. The approach is entirely from a clinical standpoint. It does not constitute research except insofar as it incorporates those postulates and procedures which best produce the desired results for our patients in our practice and in the practices of a fairly large group of men in our vicinity with whom we work very closely.

We make a careful case study of each case, after which our diagnosis, prognosis and general aim is formulated. We advocate no set method or procedure. We do have a general skeletal outline around which we build the particular procedure to be followed in each case. For years we have read everything we could find and listened to practically all who lectured, and we have added and discarded as our experience seemed to indicate. We believe that progress and advancement come in optometry as in all other professions and sciences by revising old concepts and refining and adding better methods. Therefore, we try out procedures eliminating those which are cumbersome and ineffective and substituting those better suited to our purpose as we find them. These will most certainly not be the same in each case nor even the same in an individual case with different operators. Procedures may differ and explanations of phenomena may differ, but the general aim remains the same. Which, of course, is to assist each person to achieve the greatest degree of visual comfort and efficiency consistent with his visual aptitudes.

POSTULATES UPON WHICH TRAINING IS BASED

First of all, it is essential that we agree on a series of facts which constitute the basis of the training about which I shall speak. We believe that the child learns to see. This is based on the work of Gesell and those working with him, presented by Gesell and Amatruda in "Developmental Diagnosis". We call attention particularly to research by B. C. Ling under Gesell's direction at Yale in 1941: "A Genetic

*Read before the Twenty-second Annual meeting of the American Academy of Optometry, on December 10, 1945 at Columbus, Ohio. For publication in the November 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow of American Academy of Optometry.

study of Sustained Visual Fixation and Associated Behavior in the Human Infant from Birth to Six Months", (Journal of Genetic Psychology, 1942, *61*, 227-277) Ling found, among other things, (p. 271) "opposed to the strictly nativistic hypothesis . . . are the . . . absence of convergence until about . . . the end of the second month". "Learning through use starts as soon as the child is born." (p. 274) "Binocular fixation, which is generally, though not invariably characterized by convergence, first appears at about 7-8 weeks." (p. 274) "When convergence first occurs, it is carried out by a series of globus jerks. Time and practice together gradually eliminate these jerks and give convergence a smooth and continuous appearance". Motion pictures taken under Dr. Gessell's direction show that the achievement of convergent fixations are clearly and unmistakenly a matter of what Dodge calls approximation and correction. This is interpreted as a clear case of learning in infancy.

Whether this learning is based on an innate pattern or entirely learned does not affect the matter from a practical standpoint. We believe, then, that as the learning progresses, the movements involved assume a characteristic pattern made possible by the progressive organization of the nervous system. This is then called a behavior pattern. A behavior pattern is simply a defined response of the neuro-motor system to a specific situation—a movement or action which has definite form. (Gesell and Ilg, "Infant and Child in the Culture of Today").

From clinical experience we know that these patterns vary and that they are as characteristic of each individual as are his other patterns such as speech, walking, etc.

When the child or adult takes this learned pattern to a new environment, it follows out the general pattern of human behavior.

What is this pattern? When the equilibrium of a living organism is disturbed, it makes or attempts to make some adequate adjustment to its environment.[1]

Functional disorders arise when the environmental changes demand adjustments which exceed the organism's powers of purposeful adjustment; it is then we see evidence of the disturbance of equilibrium of functions.[2]

This equilibrium exists in the neurological pattern rather than in the postural set of the mechanism. Discomfort in eyes tells us that some form of adaptation was attempted which was beyond the ability of that particular visual system. Every visual problem can be stated as the problem of what the organism under consideration has done to

adapt the entire seeing mechanism to the situation created by the artificial visual task presented to him by his work.[3]

That these shifts are made can be proven in any optometric office and are proven by the visual statistics gathered by educators and more recently by Tiffin.[4]

There are various ways that the organism can adapt to its problem. It can retreat from the visual task (retarded reader, non-reader, avoidance of desk and machine), it can produce a localization of discomfort, it can become a myope, it can suppress and/or become a squinter.

What causes the difference in individual adjustment? Schaffer[5] tells us that: "If an individual has a high personal endowment, a very great obstacle can be easily overcome. The individual by virtue of healthy genes has an inborn power to adjust to his environment and adapt to situations. He gets along because he has the requisite biological equipment."

When a patient comes in to us and we make an examination—visual analysis—visual case study—we are actually using controlled devices for eliciting patterns of behavior.

WHAT CONSTITUTES A VISUAL CASE STUDY

Complete Case History

Age, 1st Rx prescribed, how worn, frequency of changes, patient's reaction to changes. Complaints occasioning changes. Familial ocular history.

Health history, in detail.

Where poor scholarship and reading difficulties are a part of the complaint:

Developmental history

Educational history

Siblings' history as far as necessary.

External Examination

Dominancy: hand, eye, ear, and foot.

Versions and fixations

Push-up

Ophthalmoscopy

Complete refraction including:

Ophthalmometer measurement

Retinoscopy

Subjective finding

Phorias
Ductions
Equilibrium Findings
Cross-cylinder Findings

Tests for fusion, stereopsis, macular and peri-macular suppression.
Motor control, i. e. hand and eye coordination.
Accommodative response
Perceptual Span
Perimetric Findings
In reading problem cases—ophthalmograph record, reading and comprehension tests.
Any additional tests which seem to be indicated, and take into consideration any other significant facts concerning the person's life. Dr. Frederick Knight, Purdue University, "You do not prescribe glasses to eyes. You prescribe glasses to the total person."

When all findings and all significant facts have been considered, we evaluate the case. The evaluation of the case is not based on any one or two findings but on the entire picture.

THE SELECTION OF CASES

Varies according to professional discretion. Visual training had its beginning in the restoration of normal function. Its ultimate aim must be preventive and in the development of visual abilities far in excess of those which now seem adequate.

1. Squint cases

most obvious

2. Amblyopes
3. When lenses will not solve the problem.
   - A. So called C type.
   - B. Beginning myopes. Progressive myopes or those interested for one reason or another in increasing their acuity without lenses.
   - C. When lens acceptance is plano and a visual complaint exists that is not associated with a health condition.
   - D. When any basic skill has been sacrificed and when that skill is a necessary adjunct to the satisfactory achievement of the individual.
   - E. Many children who are not achieving in school.

Obviously not all who come under those headings are given training. Training is contra-indicated when:

1. The person whose motivation is low, that is, the person who needs it but to whom it must be sold over the mere statement of the situation.
2. The person who wants it but cannot give it adequate time. We may hope for an accelerated routine, but the procedure we have today takes time. If it is a learning process we must have time. There is as yet no royal road to learning.
3. The person with a poor health history or whose visual fields indicate an ocular manifestation of a general systemic disorder.

GENERAL RULES FOR TRAINING

Our main objective is the restructuring of perceptual fields. To do this we must by-pass the eye itself in order to create within the central mechanism a new pattern.

The premise to remember is that no phoria, duction, loss of fusion or any other finding constitutes the visual problem. They are merely symptoms of a visual problem. They are the distortions within the patterning which we elicit during our examination.

Handicapped children should be located as early in life as possible and remedial and developmental training procedures instituted as soon as possible. If possible, do not wait until children screen themselves out.

Time is well spent in bringing the patient to the proper attitude before any practice is given.

Build the situation so that particularly a child can succeed thus giving a feeling of security.

Visible results keep patient aware of progress, hence allow him to see his goal.

The general attitude must be that of effort intelligently expended, (relaxed alertness).

Typical picture is one of fairly rapid progress followed by periods of little or no improvement. Keep patient encouraged by showing him that these periods of slow improvement are laying the groundwork for the next intensive gains. Learning may be proceeding without showing in performance.

The objective is correct performance. Speed comes incidentally.

A proper and adequate habit has been built up when the function is stable.

Frequency and length of training periods vary with the individual case and with professional discretion.

Frequent checks should be made to determine the progress of the

case. Procedures should be employed or varied according to the exigencies of the case. Methods should be flexible and adaptable in detail but immovable in fundamentals.

PROCEDURE

It has been found to be effective to establish monocular skills first. This consists of the monocular ability to (1) maintain fixation on a moving object in all parts of the field and (2) to change fixation from one point to another without the necessity of corrective movements. When these movements can be accomplished smoothly and accurately without spasticity or overswings they are assumed to be adequate. During this same period *facility of accommodative change* may be developed. We believe this to be one of the most important steps and one frequently overlooked.

We then proceed to binocular skills. We approach this in rotations by the old diplopia exercise of Dr. Peckham. Develop fusion by any or all known methods. Eliminate suppressions by all methods including cheiroscopic drawing. Develop depth perception by all methods including the orthofusor. Build ductions. Develop perceptual span.

Work for acuity in those cases where it is desirable. Figure-ground sequence for general perceptual reorganization. This is an outgrowth of graduate research work done at Ohio State University in the Department of Experimental Psychology under Dr. Samuel Renshaw. It bears a close relation to the perceptual and recognition training which has been an astounding success in the Army and Navy and which was also originated by Dr. Renshaw. This technique will not be demonstrated at this time because an adequate presentation would consume too much time. However, we believe it will become one of our most valuable procedures.

The final objective in all cases is to establish those skills necessary for comfortable performance with the greatest degree of efficiency up to the limits of aptitude and achievement of each individual.

1315 WISCONSIN TOWER
MILWAUKEE 3, WIS.

COMMENTS ON ORTHOPTICS*

Robert E. Bannon†
Hanover, New Hampshire

As a preface to this discussion on Orthoptics I want to make certain, if possible, that my position and my intentions are not misconstrued. I am quite well aware that this subject is a controversial one and that there are some strong personal emotional feelings which occasionally seem to dominate factual evidence or reason.

In teaching, as well as in other professions dealing with human beings, there are two main types of presentation. One method attempts to instill knowledge by the use of reason and the other method appeals to man's emotions. Depending on the subject, both methods have, no doubt, their value and their justification. With respect to scientific subjects, however, the emotional appeal should be minimized and credence given solely to well-authenticated evidence no matter how dryly presented.

In this discussion, I am going to refer to the Optometric Extension Program and I realize that I may be treading on dangerous ground for it often appears that if one criticizes the Optometric Extension Program's teachings he is automatically classed as an antagonist; on the other hand, if one does not criticize, he is classed as "one of the fold." Yet, anyone seriously interested in research and the profession cannot simply ignore the influence that the Optometric Extension Program has had on optometric thinking and practice. I do want to acknowledge that the efforts of the Optometric Extension Program have succeeded in stimulating many optometrists to strive for better methods of practice.

While the influence of Donders, Landolt and Maddox may have faded with time, the work of Percival and Sheard appears to have served as a basis for that part of the Optometric Extension Program which deals with the interrelation of ocular functions through the as-

---

**Abridgment of the material presented before the New York Academy of Optometry, New York City, February 19, 1946: The Iowa Chapter of the American Academy of Optometry, Des Moines, Iowa, April 15, 1946, and the Maine Optometric Association, Lewiston, Maine, May 19, 1946. Also published under the title, "Some Physiological, Psychological and Educational Aspects of Orthoptics and Visual Training", Optical Journal and Review of Optometry, June 15, 1946. Submitted on August 8, 1946, for publication in the November, 1946, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Assistant Professor in Applied Physiological Optics, Dartmouth Eye Institute, Hanover, N. H. Fellow, American Academy of Optometry.

sociation of accommodation and convergence. The writings of Dvorine, Morgan, Fry, Haines, Shepard, Betts, etc., have provided a background for this part of the Program; however, I have found it difficult to understand the rationale of some of the more recent developments in the field of visual training as described in the Optometric Extension Program or by those who profess to follow it. During the past few years I have devoted some time and study in an effort to clear up for myself some of the more obscure points in this interesting field of orthoptics and visual training, and I would like to present for your consideration the results of this study. I have had no personal motives in my discussion of this subject for my interests have been purely academic and clinical.

Historically[1,2] orthoptics dates back to the seventh century although strabismus was known to the ancients. Paulus Aegineta (625-690 A. D.) a Greek physician, advocated the use of a mask with small holes over each eye to correct strabismus. He also advised that pieces of colored wool be attached to the outer angle of the eye in cases of convergent strabismus.

A long period followed without any change in the methods of treating strabismus. Ali Ibn.Isa, of Bagdad, who is credited with writing the most complete of the pioneer textbooks on ophthalmology about the year 1000 A. D., continued the advice of using the mask and the colored wool in children born with strabismus. In cases of squint acquired later in life, Ali Ibn Isa prescribed collyria made of such ingredients as the juice from a calf's lung, pigeon's blood, milk and olive oil.

In the 16th century, Ambrose Paré, famous French surgeon, and Bartisch, the founder of German ophthalmology, confined themselves in the treatment of strabismus to the use of the perforated mask with but slight improvements in design.

It was not until 1743 that Buffon, the French scientist, recommended covering the good eye to force the use of the squinting eye. He also made a logical attempt to explain strabismus as being a result of anisometropia and he emphasized the need for equalizing the two eyes as far as possible by corrective lenses before attempting to cure the squint. Buffon's insistence upon constant exercise of the deviating eye may be said to have been the first sound method of orthoptic training.

The next important contribution to the study of orthoptics was made by Erasmus Darwin in 1801. He confirmed Buffon's ideas and recommended either total or partial occlusion of the better (non-squinting) eye.

Wheatstone's invention of the mirror stereoscope in 1838 almost coincided with the first sound attempt by Diffenbach in 1839 to treat squint surgically. Because of the unfavorable results first obtained, Javal described strabismus surgery as the "massacre of the oculomotor muscles." Javal deserves the credit for establishing the use of the stereoscope in the treatment of strabismus and for showing that binocular single vision may be developed by means of exercise with it. Although for many years Javal enthusiastically advocated orthoptic training, rather than surgery, for squints, nevertheless he concluded his famous book "Strabisme," published in 1896, with the observation that experience had taught him that people were not worth so much trouble, and he eventually looked upon operation as a valuable means for shortening the course of treatment. Everyone is familiar with Javal's stereoscopic cards, which have been largely reproduced in the Wells series and in other subsequent series.

Although in Donders' classic "Accommodation and Refraction of the Eye" (1864) there is little or no evidence that he advocated any form of orthoptic training, yet his work on the association of refractive conditions and motility anomalies deserves mention in any review of the development of orthoptic training because a considerable advance was made in the treatment of accommodative squint by the clarification of the relationship between accommodation and convergence.

It is interesting to note that Donders relates that the first suggestion of using prisms in the correction of strabismus came from Dr. H. Krecke, of Utrecht, in 1847. Krecke was not a medical man, but a physicist connected with the Royal Meteorological Observatory of Holland.

Toward the end of the 19th Century attention was finally drawn to the idea that the *ocular muscles* themselves were not wholly responsible for strabismus, but, rather, faulty *innervations* to those muscles were often responsible. This point of view was taken up by Mackenzie, Duane, Priestley Smith, Parinaud and Worth, and considerable progress ensued. Mackenzie wrote: "The cause of squint should be sought elsewhere than in the muscles of the eye, elsewhere than in the retina; that is to say, in the brain and the nerves, organs which preside over the association of the acts of the muscles of the eyes."

Maddox who invented the Maddox rod and the Maddox wing test wrote a great deal on heterophoria and the orthoptic treatment of muscular anomalies. He was the first to mention that nearness calls forth a subconscious stimulus to accommodation and convergence.

Modern systematic orthoptics owes considerable to the work of Claude Worth, who in the earlier part of the 20th century presented his "fusion theory." He also invented the amblyoscope which is the prototype of many elaborate orthoptic training instruments in use today.

The work of Cantonnet and Filliozat brings us up-to-date in this brief survey of the historical developments of orthoptic training. Their chief contribution is in the use of the patient's own "mental effort," operating through suggestion and imagination, in an effort to correct faulty innervations to the squinting eyes.

No doubt, there have been many omissions in this rapid survey, particularly in the valuable work by Americans during the last 50 years; however, for this recent era and the work of such men as Peckham, Sheard, Feinbloom, Hardy, Guibor, Berens, Brock, Skeffington, etc., there is an abundant fund of literature quite readily accessible. One purpose of this bird's-eye view of the beginnings of orthoptics is to contradict the idea that orthoptic training is a new or recently discovered field of eye care; rather it has had a long history.

There is, however, a type of orthoptics which has become known as "visual training" and which may have some claim to being a recent development in the field of visual science. In this training there has been the endeavor not only to improve the neuro-muscular conditions of the eyes but also—and this part has been given considerable emphasis during the recent war years—to improve the visual acuity without the ultimate use of refractive lenses. I was interested in studying some of the foundations upon which this newer type of training is based.

While it may be resented, it is nevertheless true that the first popular attempts, on any large scale, to improve vision without the aid of glasses were made by the late W. H. Bates, M.D.,[3] of New York City, whose bizarre claims and practices began to receive attention just prior to World War I. In 1917 Bates and Bernarr Macfadden, the "physical culture" faddist, collaborated on "A New Course of Eye Training," which was advertised in the magazines. The association of Bates and Macfadden did not last long for, in 1919, Bates began his own publishing of "Better Eyesight—A Monthly Magazine Devoted to the Prevention and Cure of Imperfect Sight Without Glasses."

Bates and his followers claimed they were able to relieve many people of their glasses and to make them see better or, at least, with more assurance. The average individual is not capable of detecting the

pseudo-science of Bates' theories and techniques and, indeed, insofar as most people are concerned the technical aspects are unimportant as long as the goal of being able to see without glasses is achieved. Bates' theory of accommodation is patently incorrect, but does it follow that his whole system of training people to see better is unsound?

Huxley[4] in his book "The Art of Seeing" comments favorably on Bates' methods: The value of relaxation and the unfavorable influence of tension, the important influence of fear of light, fear of blindness, fear of using the eyes, etc. Bates was correct in maintaining that vision was not solely a matter of optics; that attention and treatment should be given to the cerebral aspects of seeing. While on this subject, it is interesting to note that Bates was far from the first to be concerned about the psychological aspects of vision. In 1709, Bishop Berkeley presented his "Theory of Vision" which was (quoting from a recent paper[5] in the *Brit. J. of Opth.*) "a psychological study and the first attempt to distinguish purely visual sensations from those in which sight is aided by the other senses."

It is difficult, of course, to weigh how much influence, if any, the theories and practices of Bates had on present-day visual training techniques. More pertinent to current practices is the scientific work of Frank N. Low,[6] who reported that "The evidence indicates that peripheral visual acuity can be trained." Also there are the investigations of Hugh McFadden,[7] who found that visual acuity could be improved by practice or training. McFadden stated: "The level of performed acuity may be substantially raised through practice. The curves of improvement have the general form of the acquisition (learning) type." McFadden quotes the work of Volkman[8] (1863) and Wilcox[9] (1936) as having also demonstrated that acuity can be improved by training.

Renshaw's[10] work in speed of recognition further emphasizes the influence of training on visual achievement. Renshaw states: "The difference between the expert and the novice in the rapid and accurate perception of visual material is the same difference between the expert and the novice in the performance of any skillful act. We have to learn to see just as we have to learn to swim, to play the piano, or to speak French. This can be done with skill and efficiency or it can be done haltingly and ineffectively."

Renshaw's work at Ohio State University has given considerable impetus to the recent enthusiasm in visual training. Although his reports have been distributed for optometric consumption through the medium of the Optometric Extension Program papers and seminars,

the best scientific and concise report of Renshaw's contributions is presented in his paper,[11] "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods," published in the *Journal of Psychology* (1945). In this paper, Renshaw describes his study and training in 1934-36 of Salo Finkelstein, the lighting calculator, who by training increased his own superperformance.

Renshaw was successful in training university students who equalled, and in some instances surpassed, Finkelstein's world records. He concluded that the trained perceiver differed from the untrained mainly in that he used a different set of functions. "As skill approaches virtuosity, sensory features recede and the process becomes essentially motor." "In tachistoscopic work the exposure time-length of material relation is a function of grouping and field-organization in perception." Renshaw further concluded: "Tachistoscopic training with digit patterns produces marked increase in reading comprehension and speed, measured by standardized tests. It enlarges form fields, in the vertical as well as horizontal meridians, and assists in the reduction of (adventitious) myopia." Furthermore, Renshaw states that his method of training used in naval aviation ". . . has made a useful contribution to the more accurate and speedy identification of airplanes and ships."

The work of Volkman, Hugh McFadden, Low, Renshaw and others who found that "practice makes perfect," is, no doubt, the basis of the system of visual training developed by Skeffington and his associates. This system has been taught through the medium of the Optometric Extension Program and may be summarized briefly, as follows:

1. The assumption is that every non-diseased eye is capable of good vision and is inhibited largely by defects not only in the optical system but also in the function of the brain system of reflexes, thought patterns, sensory and motor impulses and responses.

2. Training consists of improving visual skills by (a) breaking up improper associations of convergence and accommodation; (b) relaxing the over-stimulation of accommodation by appropriate plus lenses and/or training; (c) relaxing the over-stimulation of convergence by appropriate prisms and/or training; (d) providing rotational exercises and fusion training to control jumpy fixations; (e) providing exercises or training in stereoscopic recognition; (f) providing exercise, training and practice in the accuracy and speed of recognition.

Although by these and similar procedures improvement in visual acuity, efficiency and comfort has often resulted, the unfortunate con-

clusion has been reached by some that a significant change in ametropia has been effected accordingly.

Besides the optometric approach to visual training in cases of myopia, there are a few medical references worthy of consideration. Emanuel M. Josephson M.D., in his book[12] "Near-Sightedness is Preventable," (1939), states that: "Early and moderate near-sightedness can be cleared up completely. Advanced near-sightedness can merely be reduced or its symptoms relieved" (p. 40). Josephson stated that he first presented his technical material in a paper which he read before the 15th International Congress of Ophthalmology at Cairo, Egypt, in December 1937. He maintains that: "The prevention of near-sightedness hinges largely on the prevention of disturbances of the water-salt metabolism of the body" (p. 28) and ". . . Malnutrition and defective diets play a large role in causing glandular disorders and the other disturbances which give rise to near-sightedness" (p 28).

Josephson has also linked near-sightedness with sexual disturbances." He writes: "The most malignant type of near-sightedness, that progresses rapidly and steadily to complete blindness and even to rupture of the eyeball due to overstretching, occurs with highest frequency in girls who fail to develop sexual cycles, or in whom the cycles are extremely intermittent."

Josephson's treatment of myopia consists of adrenal cortex hormone supplemented by increased salt and vitamin intake (p. 38). He also states that: ". . . Eye muscle exercises, with such apparatus as the stereoscope for instance, are essential for the relief of the symptoms of near-sightedness due to eye muscle imbalance" (p. 39).

The problems of myopia and various attempts to improve the vision without the orthodox recourse to glasses has been carried out, not only in this country, but also in Europe and Asia. For instance, in 1941 in Japan, where near-sightedness is so common, N. Ohyama[13] reported his treatment of incipient near-sightedness in the *Nippon Gankagakkai Zassi* (*Journal of the Japanese Ophthalmological Association*). Ohyama's methods consisted of: The wearing of convex glasses, repeated instillation of a weak atropin solution, and exercise for dissociating convergence from accommodation by using the haploscope.

Regarding the claims that myopia can be actually reduced, several competent investigators have shown that this inference is unwarranted. Stoddard,[14] of the University of California, in his study (1942) of the "Physiological Limitations on the Functional Production and Elimination of Ametropia" concluded that while "pseudo-myopia can

be eliminated by orthoptic means, . . . attempts to functionally correct true myopia even of low degree on a constant basis are futile."

Lawrence Post, in discussing Lancaster's paper[15] "The Present Status of Eye Exercises for Improving Visual Functions," reported that he had investigated the subject of improvement of visual acuity in myopes and while the visual acuity had been improved appreciably by exercises, or training, in several cases, there was no evidence of a significant change in the ametropia.

Alan C. Woods,[16] of the Wilmer Ophthalmological Institute, reported on the results obtained in treating myopia by visual training. The training methods were administered by Skeffington and his associates. Briefly, the conclusion reached was that the visual training was of no value in curing myopia, although slightly more than half the patients did show some slight improvement in visual acuity.

In 1942, I reported, in a short paper[17] "On the Reduction of Myopia," the case history of a young man who was slightly myopic, with and without cycloplegics, but whose vision was improved by training from 20/40— to 20/20—, sufficient to enable him to become a naval officer after he had first failed the visual requirements. This young man, after three years in the Navy and just before his discharge, requested glasses so that in civilian life he could see best without any recourse to the sometimes doubtful recognition of slightly blurred objects. The degree of myopia had remained substantially the same over the three-year period. .

There have been several other cases of young men seen at the Dartmouth Eye Institute who, with the incentive of meeting military requirements, have trained themselves to go without their myopic corrections, only to request them after the need of satisfying Army or Navy standards had passed. Of course, there are others who have preferred to continue without glasses, presumably because their visual needs for maximum distance vision were not so exacting or because of some apathy toward wearing glasses.

Physiologically, improvement in visual acuity by training is not so strange. The physiological limits beyond which our sense of vision can be developed have not been rigorously determined. It was once thought that the maximum vision of an emmetropic eye was 20/20. The Snellen charts and similar devices that are commonly used for testing the eyesight and determining the visual acuity are all based on this convention which is, in turn, based on the assumption that the resolving power of the fovea, as determined by the angular interval between

points that can just be discerned as separate and distinct, is one minute of arc.

It was Euclid who first estimated the average resolving power of the eye to be about one minute of arc. The early anatomical measurements of Kölliker indicated that the average diameter of the smallest visual cell of the retina was about 0.0043 mm., an interval which subtends an angle corresponding to one minute of arc at the nodal point of the eye. Hence, it was natural to jump to the conclusion that in order for the eye to distinguish two adjacent points as being separate, their retinal images must be at least as far apart as the distance between two adjacent cones in the fovea. However, more recent and more accurate measurements (e.g., by Osterberg[18] in 1935) give much smaller values (half as much as those found by Kölliker) for the diameters of the macular cones. It should be kept in mind that the definition of unit (20/20) visual acuity is merely a convenient, somewhat arbitrary standard. Many emmetropic eyes can see 20/15 and occasionally 20/10.

The improved visual acuity resulting from training does not contradict any physiological principles. Good eyesight is acquired not only by a physiologically sound organ, but the organ must be aided by a long process of training, practice and experience. Adult vision is an accumulation of observations and associations of ideas of all sorts and is quite different from the untutored vision of the infant who, besides being unable to focus and adjust his eyes accurately, has not yet learned to interpret correctly what he sees. Incidentally, Feinbloom[19] found that the greatest problem in subnormal vision patients was the necessity of teaching these patients "how to see." We all have to learn to use our eyes and interpret what we see just as we have to learn to use our legs to walk and our tongue to talk. As Lancaster says in his excellent paper,[15] "The Present Status of Eye Exercises for Improving Visual Functions":

"One of the fundamental laws of biology is that repetition of an act facilitates its performance. The first time one does something it may be done clumsily and laboriously, the hundredth time it may be done dexterously and with ease. No principle of physiology and psychology is more firmly established than this."

Before leaving the subject of physiological optics, it would be well to point out the absurdity of some recent statements of some of those most enthusiastic about visual training. For instance, some scoff at what they call "the eyeball theory"—implying, it seems, that the length or contents of the eyeball has little, or nothing, to do with ametropia and visual acuity. Some maintain that the hyperopic eye and the myopic eye

are the same size, that the ametropia is due to anomalous "brain patterns." Actually, enucleated hyperopic eyes have been found to measure 20 mm. in length and myopic eyes as much as 36 mm. in length. Other amazing new declarations have cast some doubt on whether or not an actual image is formed on the retina. Scheiner as long ago as 1625 removed the external coatings from the rear of an enucleated eye, exposing the transparent retina to view from behind and saw thereon a miniature reproduction of luminous objects in front of the eye, much the same as can be seen on the ground-glass focusing screen of a photographic camera.

The basis of so-called visual improvement in acuity is not that the dioptric image is necessarily made any better, but that advantage is taken of "shape or form vision" which is primarily a function of non-macula imagery. We do two kinds of "seeing." When we look at something which is completely new to us, we are concerned about detail. The eyes explore the new object so that each part is imaged within the fovea and at the same time, if at all possible, we explore the object with or by our other senses. When we look at a familiar object, we are no longer so interested in detail. We merely scan a familiar object sufficiently to recognize it, aided by our past experiences and awareness of the situation at hand. Actually, we need only to see a small part of a familiar object to identify it. We need only to see the outline, shape, or form of some objects which may be imaged upon some low resolving peripheral area of the retina in order to perceive what it is. The area of the retina capable of shape recognition is extremely large in comparison with the fovea and it is this large "shape recognizing" area that is capable of considerable improvement by experience and training.

While in the learning stage, tasks which require the recognition of detail are soon performed with much greater efficiency when guided only by "form vision." The experienced hunter is able to recognize animals by their movements in the underbrush or a fleeting glimpse of their shape as they run away. He does this by his peripheral vision rather than his foveal vision. The efficient reader does not fixate foveally every letter or word as does the novice; he scans or sees peripherally the general shape of words and thereby is able to read faster and with less effort. It is so natural for one to direct his fovea to new objects that he does so instinctively despite the fact that he may have a central corneal opacity or a central scotoma. Such is the case of Aldous Huxley who learned to use his peripheral vision and became able to read ordinary print with no better than 20/150 central visual acuity.

The value of "form vision" in recognizing familiar objects and in paving the way toward sound visual training techniques cannot be overemphasized. The influence of dioptric anomalies, on the other hand, cannot be minimized. Knowledge and appreciation of these two points should assist us in dealing with our patients. For instance, insofar as optics are concerned it would seem that a refractive condition of 2 D. of astigmatism would present to an individual certain difficulties of about the same order regardless of whether the astigmatism with with-the-rule, against-the-rule, or oblique. From practical experience we know that this is not so.

A non-presbyopic person having 2 D. astigmatism with-the-rule may see 20/30 or even 20/20, but if he has the same amount of astigmatism against-the rule his visual acuity may be only 20/100. Why is this so? The optics of the two cases does not explain it. However, the explanation lies in the aforementioned matter of "form vision." Letters of the English alphabet are recognizable primarily by their vertical contours. If the vertical strokes of letters are blurred, as in against-the-rule astigmatism, the letters are very difficult to recognize. But if the vertical strokes are fairly clear and the horizontal strokes blurred, or even missing, the letters are quite easily recognizable. Therefore, it follows that against-the-rule astigmats have more trouble, are more inefficient, than those having the same amount of with-the-rule astigmatism. It also follows that it is possible to train a person having 2 D. with-the-rule astigmatism to pay attention to the shape, rather than to the detail, of letters. But to do the same in the case of a person having the same amount of against-the-rule astigmatism is not so easy. It should be pointed out that the criterion of visual acuity as judged by the ability to read letters is not necessarily a fair estimation of what a person can see on objects other than letters. That is, a person who can read 20/40 Snellen letters readily but with training succeeds in deciphering the 20/20 line of letters, will not show the same improvement on the Landolt broken ring chart nor will he show a corresponding improvement in his ability to recognize ships at sea or aircraft in the sky. Yet, there is some carry-over effect by training on letters or on digits. For instance, there is evidence that improved recognition of certain objects does enable one to perceive other objects better and to function visually more efficiently.

John Maude of Australia believes that there is a relationship between orthoptics and artistic merit. He found[20] in studying a group of about one hundred people of various ages that those who showed superior ability in perspective drawing had excellent convergence and stereopsis,

whereas the majority of those who had fair or poor artistic merit had poor or no convergence and stereoscopic ability. Maude suggested that teachers should take into consideration his opinion "that pupils of all ages who seem dull and stupid in perspective are more likely to be suffering from a defective binocular apparatus than a defective mentality."

Similarly, Prof. Sherman[21] of the Art Department of Ohio State University has found that binocular vision functions, especially, stereopsis and peripheral perception, are related to artistic achievement.

In another study[22] concerning games in which a swiftly moving ball is watched and struck by the player with a bat or racket, Maude concluded that skill is largely a matter of the efficiency of the extraocular muscles and binocular stereoscopic vision. He believes that there is the possibility of improving a player's batting average or his skill at tennis by orthoptic training.

Renshaw's[10,11] work has shown that the speed and accuracy in recognizing objects may be improved greatly by training. Furthermore, improvement in ability to read faster and with greater comprehension has resulted from orthoptic and visual training.[23] Likewise, studies[24] concerning visual efficiency in industry have indicated that binocular functions, phoria and stereopsis, are important for certain tasks.

I have tried to discuss very briefly orthoptics and the more recent form of visual training from the standpoint of historical background, physiological, psychological, and educational aspects. That some of these aspects have been neglected in recent years is pointed out by Ryer and Hotaling,[25] who say in their review of Bielschowsky's "Lectures on Motor Anomalies": ". . . much of the treatment accorded ocular motor anomalies has been based upon superficial, if not basically unsound, premises. In no other branch of optometry and ophthalmology have glib talkers, fanciful writers, fantastic hypotheses, unwarranted claims and over-rated instruments been so uncritically accepted as in that of orthoptics. Such general acceptance of superficiality denotes a general lack of fundamental knowledge . . ."

Much, if not all, of the misunderstandings and controversies on the subject of orthoptics and visual training has resulted from one school of thought believing, and trying to make others believe, that their tenets are the sole answer to the problem. It is as fallacious for the "medical-physiological-physicist" group to stand fast on their beliefs as it is for the "functional-psychosomatic" group to attempt to maintain their convictions. One group cannot ignore the findings of the other and purport to be scientific or reasonable. It is as foolish to believe that the char-

acter of the dioptric image is the *sole* determining factor in what a person can see, or in what he can accomplish with respect to visual tasks, as it is to insist that the dioptric image has *nothing* to do with seeing but that this faculty is primarily dependent upon "cerebral patterns," "inhibitions," and "concessions."

Specifically, the biggest obstacle to the acceptance by orthodox optometrists and ophthalmologists of the value of orthoptics and of visual training has been the implication that by such means anatomical anomalies may be significantly changed. Bielschowsky objected to the conclusion that phorias could be reduced by orthoptics because, by definition, "phoria" meant the fusion-free position of the eyes. He would acknowledge that by means of orthoptics the fusional amplitudes could be improved and thereby the patient could more easily maintain parallelism of the visual axes. Nevertheless, he insisted that the original deviation (phoria) could be made manifest once the fusion had been adequately suspended by, for instance, the cover test or monocular occlusion.

Likewise, in the cases of improved acuity resulting from visual training, the assumption that the degree of ametropia has been reduced, is scientifically untenable, because by standardized tests the same amount of ametropia (within the limits of measurement) can usually be found.

This same fallacy has been made with respect to aniseikonia. Recent claims by some ophthalmologists and optometrists have implied that aniseikonia could be "cured" by orthoptics or visual training. Here again it is a matter of definition of terms. What is really intended is the *symptoms* due apparently to aniseikonia can be relieved or reduced by visual training. But to maintain that the actual condition of an image size difference can be wiped away by visual training is erroneous and shows only lack of knowledge of physiological optics. In a paper,[26] "Heterophoria and Aniseikonia" (1939), I pointed out that certain cases of aniseikonia were handled best by treating only an existing, and hitherto uncorrected, refractive or motility anomaly. Many of these cases were made comfortable without an aniseikonic correction but, nevertheless, the aniseikonia still existed. Furthermore, careful experiments[27] of the effects of wearing an aniseikonic lens indicated that a certain amount of image size difference could be "tolerated" by some individuals without any untoward effects—yet, daily measurements showed substantially the same amount of aniseikonia as that introduced by the lens worn.

By way of summary: It is true that by training, practice, and experience, a certain amount of muscular imbalance, ametropia, or aniseikonia may be tolerated or "functionally compensated for," that is, the individual may perform as though he had no anomaly—yet by

actual measurements it can be determined that the original anomaly is still present. The realization and frank admission of this point is the best, and in fact the only, means of establishing rapport between the "anatomical" and "functional" schools of thought.

To forego, and even denounce, the implication that visual training alters the degree of ametropia, phoria, or aniseikonia should be the future course of those interested in visual training.

It is a significant accomplishment to achieve comfort and better efficiency by visual training for those patients who need training in how to use their eyes better for purposes of improved athletic or artistic achievements, better reading ability, greater accuracy in industrial tasks and facilitation in seeing in general.

The burden of proof that myopia, or any form of ametropia, can be reduced consistently is upon those who make such claims. The class of charlatanism is deserved by those who make unwarranted pretensions, and the profession of optometry suffers every time one of her members purports to accomplish some sensational end but fails to present unequivocal proof. What would constitute unequivocal proof? The proponents of visual training for the reduction of myopia indicate by their technique that they are attempting to remove or correct "faulty habits, patterns or skills." The inference is that a person becomes myopic because he does something *wrong* in his attempt to "satisfy the needs of his environment." Now, just what is it he does wrong and can it be measured? Is there a certain wrong use of the eyes which makes one myopic, and is there another kind of wrong use of the eyes which results in hyperopia, or in astigmatism? If it can be determined: (1) What it is that the myope has done wrongly, and that this habit is peculiar to the myope only, and (2) Training is directed specifically to correct this fault, so that (3) The same tests which first detected the faulty "habit, pattern, or skill" indicate clearly that it has been corrected, and (4) Should standard objective and subjective refractive tests show a significantly different degree of ametropia, allowing for the limit of error of measurements, following training as compared to before training, and (5) If this type of evidence can be obtained on a minimum of 100 cases by different practitioners following the same methods, then (6) It may be claimed that there is unequivocal proof of the reduction of myopia by visual training.

REFERENCES

1. Wheeler, Maynard C.: "The History of Orthoptics." *Am. J. Ophth.* 25 (5), May 1942, 569-574.

2. *Dioptric Review* (Apr. 1937): "A Brief History of Orthoptics." Reprinted in *Optical Developments*, 12 (14), Nov. 1943, Riggs Opt. Co., Chicago.

3. Bates, W. H.: *Cure of Imperfect Sight by Treatment Without Glasses.* Central Fixation Pub. Co., New York, 1920. "Miscellaneous 'Specialists' "—Prepared and issued by The Bureau of Investigation of the *J. of the A.M.A.*

4. Huxley, Aldous: *The Art of Seeing.* Harper Bros., New York, 1942.

5. Murray, Michael: "An Introduction to Bishop Berkeley's Theory of Vision." *Brit. J. Opth.*, 28 (12), Dec. 1944, 600-611.

6. Low, Frank N.: "Studies on Peripheral Visual Acuity." *Science*, 97: 586-7, June 25, 1943.

7. McFadden, Hugh B.: "Visual Acuity." Optometric Extension Program, Duncan, Okla., 1940.

8. Volkman, A. W.: *Physiologische Untersuchungen im Gebiete der Optik.* Breitkopf & Hartel, Leipzig, 1863.

9. Wilcox, W. W.: "An Interpretation of the Relation Between Acuity and Light Intensity." *J. Gener. Psychol.*, 15, 405-435, 1936.

10. Renshaw, Samuel: "Psychological Optics." Optometric Extension Program. Duncan, Okla., 1939-42.

11. Renshaw, Samuel: "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods." *The J. of Psych.*, 20, 1945, 217-232.

12. Josephson, Emanuel M.: *Near-Sightedness is Preventable.* Chedney Press, New York, 1939, 46 pp.

13. Ohyama, N. (Tokyo): "Pseudomyopia." *Nippon Gankagakkai Zassi (J. of the Japanese Ophth. Assn.)*, 45, 1-12, 1941. Reviewed in *Far Eastern Science Bulletin* (Washington, D. C.), vol. 1, nos. 3, 4, 5, June, July, and Aug., 1941, p. 27.

14. Stoddard, Kenneth B.: "Physiological Limitations of the Functional Production and Elimination of Ametropia." *Am. J. Optom. & Arch. Am. Acad. Optom.*, 19 (3), March, 1942, 112-118.

15. Lancaster, W. B.: "The Present Status of Eye Exercises for Improving Visual Functions." *Trans. Am. Acad. Ophth. & Otolarn.*, July-Aug., 1944, 3-14.

16. Woods, A. C.: "Report From the Wilmer Institute on the Results Obtained in the Treatment of Myopia by Visual Training." *Trans. Am. Acad. Ophth. & Otolaryn*, Nov.-Dec., 1945; "Myopia Therapy by Visual Training. *Am. J. Ophth.*, 29 (1), Jan. 1946, 28-57.

17 Bannon, Robert E.: "On the Reduction of Myopia." *The Columbia Optometrist, Sept., 1942.*

18. Southall, J. P. C.: *Introduction to Physiological Optics.* Oxford Univ-Press, New York, 1937, 426 pp.

19. Feinbloom, William: "Report of 500 Cases of Subnormal Vision." *Tr. Am. Acad. Optom.* 8: 58-70, 1934.

20. Maude, John: "Optical Convergence and Stereopsis in Relation to Perspective." *M. J. of Australia*, Sept. 28, 1940. Reprinted in *Opt. Develop.* 15 (12), Dec. 1945, Riggs Optical Co., Chicago.

21. Sherman, Hoyt: "The Eye in the Arts." *Educational Research Bulletin* (Ohio State University), Vol. XXIII, No. 1, Jan. 19, 1944.

22. Maude, John: "Keeping the Eyes on the Ball." *M. J. of Australia*, Sept. 28, 1940. Reprinted in *Opt. Develop.* 15 (12), Dec. 1945, Riggs Optical Co. Chicago.

23. Fendricks, Paul: "Visual Characteristics of Poor Readers." *Contributions to Education No. 656*, Teachers College Bureau of Publications, Columbia University, New York, 1935.

Betts, Emmett A., and Austin, Agnes S.: "Visual Problems of School Children." *The Optometric Weekly*, 1940-41.

24. Kuhn, Hedwig S.: *Industrial Ophthalmology.* C. V. Mosby Co., St. Louis, 1944, 294 pp.

25. Ryer and Hotaling: Book Reviews, *J. Am. Optom. Assn.*, Feb. 1945, p. 158.

26. Bannon, Robert E.: "Heterophoria and Aniseikonia." *Am. J. Optom.*, 16 (3), 96-109, Mar. 1939.

27. Burian, Hermann M.: "Influence of Prolonged Wearing of Meridional Size Lenses on Spatial Localization." *Arch. of Opthalm.*, 30 (5): 645-666 (Nov.), 1943.

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Established 1924

Vol. 23 NOVEMBER, 1946 No. 11

EDITORS AND STAFF

Dr. Carel C. Koch ..... *Editor*
Dr. J. Fred Andreae ..... *Associate Editor*
Dr. Arthur P. Wheelock ..... *Associate Editor*
A. Virginia Huck ..... *Editorial Assistant*
Harry Brookins ..... *Advertising and Production Manager*
L. L. Koch ..... *Circulation Manager*

Publication and Academy Office: 1502 Foshay Tower, 821 Marquette Ave.
Minneapolis 2, Minnesota

Annual Subscription, $5.00 in Advance; Canada, $5.50; Foreign, $6.00;
Single Copies, 50c.

Original papers, scientific communications, clinical reports, books for review, and correspondence should be sent to the editor. Subscriptions and applications for single copies should be addressed to the circulation manager. Copy of advertisements must be sent in by the first of the month preceding their appearance. Communications with reference to advertising or other journal business should be addressed to the advertising manager. Academy correspondence should be addressed to Dr. Carel C. Koch, Secretary of the American Academy of Optometry.

Published Monthly by the
AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION

The American Academy of Optometry and the publishers of this journal have no objection to the reprinting by other magazines of any of the articles in this issue, provided such reprints are properly credited to the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

ACADEMY TO HONOR PROFESSOR JAMES P. C. SOUTHALL AT 25TH BIRTHDAY MEETING

The 1946 formal Annual Round Table Dinner of the American Academy of Optometry will be given in honor of Professor James P. C. Southall, who will receive an honorary Fellowship in the Academy at this special evening meeting.

Professor James P. C. Southall, now Emeritus Professor of Physics and former Director of the Professional Courses in Optometry at Columbia University, New York City, is one of the great living figures in physics, optics and optometry. He is author of PRINCIPLES AND METHODS OF GEOMETRICAL OPTICS, 1910; MIRRORS, PRISMS AND

LENSES, 1918, (rev. ed. 1923; 3rd enlarged edition 1933) INTRODUCTION TO PHYSIOLOGICAL OPTICS, 1937; as well as numerous essays and scientific papers. During the early twenties, Professor Southall served as the translator of the American Edition of Helmholtz's PHYSIOLOGICAL OPTICS, bringing out this monumental work in three large volumes, 1924-1925.

From 1914 until the date of his retirement in 1941 Professor Southall served as director of professional courses in optometry at Columbia University. During this period he and his associates at the School of Optometry made that institution one of the fine centers of optometric learning in America, a position it has maintained throughout World War II.

Optometry has been immeasurably benefited by Professor Southall's contributions to our science. His efforts in behalf of proper refractive techniques have advanced refractive skill to a high plane and it is with sincere pleasure and gratitude that the Academy honors Professor Southall at this 25th Birthday Meeting.

CAREL C. KOCH.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy

NEW MEMBERS OF THE ACADEMY

The following optometrists and educators have been elected to Fellowship in the American Academy of Optometry during the quarter ending September 30, 1946. The Executive Council welcomes these new members.

Dr. L. Wayne Brock, 205 Finlay Bldg., Greenville, South Carolina.

Dr. Jerome B. Conlogue, 944 Jefferson Bldg., Peoria, Illinois.

Dr. M. P. Costantini, 711 Hamilton Ave., Trenton, New Jersey.

Dr. Clifford C. Johnson, 414 Andrews Bldg., Spartanburg, South Carolina.

Dr. Joseph V. E. Lennon, 316 Sherland Bldg., South Bend, Indiana.

Dr. Herbert G. Mote, 8 E. Long St., Columbus, Ohio.

Dr. John T. Peterson, 202 City National Bank Bldg., Rockford, Illinois.

Dr. Paul M. Sims, Clarion, Iowa.

Dr. David Charles Thomson, 306 Scherer Bldg., Detroit, Michigan.

Dr. C. H. Wiesepape, 1219 Elmwood Ave., Columbia, South Carolina.

FINAL CALL FOR ANNUAL MEETING

The American Academy of Optometry was organized January 11, 1922. The coming Philadelphia meeting, December 8, 9, 10 and 11, will conclude the 24th year of Academy activity and the organization will celebrate the 25th anniversary of this Scientific Society. A large turnout of members is expected.

Under the direction of Dr. D. G. Hummel, Cleveland, Ohio, Chairman of the Program Committee the four day session will be filled to the utmost with original papers and section meetings, all of value to those interested in the ultimate of proper eye care.

Members of the Academy who have failed to reserve their hotel accommodations at the Bellevue-Stratford Hotel, Philadelphia, should do so at once.

LOCAL CHAPTERS

The Southern California Chapter met at the Los Angeles Athletic Club, September 13, 1946. The annual election of officers was held. Dr. John R. Dean was elected President, Dr. Ernest A. Hutchinson, Vice-President and Dr. Clark Deacon, Secretary-Treasurer. Following the election, Dr. June P. MacBride spoke on "Fundus Conditions Seen in Daily Practice," and Dr. John Rottman spoke on "Contact Lenses."

The Michigan Chapter held a dinner meeting at Traverse City, Michigan, September 21, 1946. Dr. Robert H. Ticknor spoke on "Optometric experiences in the United States Navy."

The New Jersey Chapter held its regular meeting September 11, 1946, at Trenton, New Jersey. Dr. William C. Walton, Jr., presented two case histories in which orthoptic training was used to improve visual acuity and Dr. J. Donald Kratz spoke on the Control of Myopia. Both papers will be presented in the December 1946 issue of this journal. The November meeting of the New Jersey Chapter will be held at the Stacy Trent Hotel, Trenton, on the 20th of the month.

The Vermont Chapter met October 7, 1946, in Hanover, N. H., by the courtesy of our New Hampshire fellows. Dinner was served at 7 p. m. at the Dartmouth Outing Club following which the group of 15 adjourned to the Dartmouth Eye Institute for the meeting. Dr. Paul Miles gave a comprehensive talk on "Testing with Maddox Rods," giving special consideration to their use as a screening device for aniseikonia. Some discussion followed. The group were then showed a slow-motion movie entitled, "One Second in the Life of a Humming Bird." The rooms of the Institute were opened for inspection and the fellows were given free access to look around and pick up ideas as desired. Credit is due to fellows Triller and Bannon for arrangements for the meeting.

During the first half of this year the New York Academy of Optometry had as guest lecturers at their monthly meetings the following educators: Dr. Samuel Detwiler of Columbia University; Dr. Selig Hecht of Columbia University; Dr. H. K. Hartline of Pennsylvania University; Dr. George Wald of Harvard University.

On the night of October 15th, Dr. Wolfgang Kohler, outstanding exponent of Gestalt psychology of Swarthmore College, was our guest lecturer. The lectures were held at Columbia University and Midston House.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

WHY PUPILS FAIL IN READING. Helen Mansfield Robinson, Director of the Reading Clinics, University of Chicago. Published by University of Chicago Press. Chicago, Illinois. 257 pages. Illustrated. Cloth. $3.00. 1946.

A panel composed of a psychiatrist, a social worker, a pediatrician, three ophthalmologists, a neurologist, a speech-correction specialist, an otolaryngologist, an endocrinologist, a reading specialist and the author who acted as a reading technician and psychologist was set up. After initial organization this group decided to study those physical, social, physiological and mental causes which may or may not contribute to retarded reading skill on the part of students. After some general study of the entire field of reading a selected block of 30 cases (all students) were given almost every imaginable test to determine their aptitudes and skills as well as their various physical and mental deficiences. Then cor-

rective measures of all types were employed and the same tests made again. Each student was constantly under observation, not only at school but in his home environment and the results of this exhaustive analysis were tabulated and reviewed by the panel.

This has been a monumental work on the part of these specialists and one which indicates, among other things, that visual problems, while needing correction, are not the prime factor in producing deficient reading skill on the part of students. It is hoped that the author may continue these studies as it is by research of this kind that progress will be made in setting the pattern of corrective measures in these problem cases.

CAREL C. KOCH

APPLICATIONS OF GERMICIDAL ERYTHEMAL AND INFRARED ENERGY. Matthew Luckiesh, D.Sc., D.E. Director, Lighting Research Laboratory, Lamp Department of the General Electric Company, Nela Park, Cleveland. Fellow, American Academy of Optometry. Published by D. Van Nostrand Company, Inc., 250 Fourth Ave., New York City. 463 pages. Illustrated. Cloth. $5.50. 1946.

The author reviews the general application of radiant energy and its affect upon the human system. This material is not presented from the standpoint of clinical application, but rather from the broader base of the use of all types of radiant energy in every day living. Luckiesh presents the wealth of facts now assembled on this subject and adds to these, the results of years of research and experimental work in the field of lighting which he has so much enjoyed and to which he has made such a marked contribution. This new book by Luckiesh is very well illustrated and should find a wide market among those interested in vision and seeing as well as many others in adjacent fields.

CAREL C. KOCH

ANNOUNCEMENTS

NEW IMPROVED IMPRESSION MOLDING SHELL

Freeman Laboratories, 116 So. Michigan Ave., Chicago, announce the development of a newly improved impression molding shell, designed to obtain a better eye impression for molded contact lenses. The

shells are so shaped as to minimize lid pressure during molding, and to allow for free flow of impression material after insertion of the shell. The shell is decentered and designed like a contact lens, so that a better ratio of superior, temporal, inferior and nasal of the impression is obtained. The countersunk perforations in the shell minimize the possibility of the impression being pulled away from the shell, and the flat tapered handle affords a firm grip. The shells are made in three basic sizes, which take care of all but exceptional cases. For these, special sizes are available.

LOS ANGELES COUNTY ASSOCIATION MEETING

The third educational seminar of the Los Angeles County Association of Optometrists will be held on Tuesday, December 3rd, at the Clark Hotel in Los Angeles. This will be the final meeting of the year.

Three outstanding men in optometry and in ophthalmology, Professor Glenn A. Fry, Professor Kenneth B. Stoddard, Dr. Raphael Koff, will present two-hour lecture periods which no practicing optometrist can afford to miss.

The afternoon periods will present Professor Kenneth B. Stoddard, Dean of the Optometry School at the University of California, and Professor Glenn A. Fry, of the School of Optometry at Ohio State University.

The full-day session will begin at 10 A. M. with a talk by Raphael Koff, M.D., prominent Los Angeles Ophthalmologist, on "The Extrinsic Muscles of the Eye." This is the lecture which was given at the University of California Refresher Course by Dr. Koff several months ago and is still spoken of as one of the most informative on the subject. Dr. Koff is an able and interesting speaker and every optometrist is urged to attend.

Attendance is limited to members of the California State Association.

THE PENNSYLVANIA STATE COLLEGE OF OPTOMETRY

Twelve optometrists, including eight veterans, just received their certificates upon completion of the contact lens fitting course given at the Pennsylvania State College of Optometry, Philadelphia. They are: Dr. Sumner Cohen, Manchester Depot, Vermont; Dr. Amiel Francke, 4607 Connecticut Ave., N. W., Washington, D. C.; Dr. Sherman Henry Mills, 1242-44-45 Book Bldg., Detroit, Michigan; Dr. Sidney

H. Moss, 431 Schoonmaker Ave., Monessen, Pennsylvania; Dr. Albert Paul, 6516 N. Bouvier St., Philadelphia, Pennsylvania; Dr. Charles Edward Pavey, 1242-44-45 Book Bldg., Detroit, Michigan; Dr. Frederick P. Pritz, 115 S. Bellevue Ave., Atlantic City, New Jersey; Dr. Phillip N. Richmond, 15 School St., Boston, Massachusetts; Dr. Robert E. Schwartz, 1209 Eutaw Place, Baltimore, Maryland; Dr. Izett Burnham Solomon, 116 Harbour St., Kingston, Jamaica, British West Indies; Dr. George V. Stephens, 3 Peachtree Ave., N. E., Atlanta, Georgia; Dr. Raymond S. Tucker, 1100 N. Sheridan Ave., Pittsburgh, Pennsylvania.

The Pennsylvania State College of Optometry announces its sixth formal course in the fitting of contact lenses from Thursday, November 21st, to Saturday, November 30th, inclusive. Classes will be held daily, including Thanksgiving Day, Saturday, and Sunday, from 9:00 a. m. to 5:00 p. m. The course embraces all types of contact lenses and methods of fitting, including trial case and moulded types, with and without the use of anaesthetics.

In addition to fitting each other with contact lenses, those enrolled in this course are furnished with an adequate supply of clinical subjects so that upon completion of the course they are sufficiently trained to commence fitting their own patients immediately.

The Pennsylvania State College of Optometry was the first recognized institution to offer a formal graduate course in the fitting of contact lenses. Each class in the fitting of contact lenses is limited to twelve students. Those interested in enrolling should direct their inquiries to the Registrar for further information and application blanks. A certificate of attendance is awarded those completing the course.

For information and application, write: Registrar, Pennsylvania State College of Optometry, 6100 N. 12th St., Philadelphia, Pennsylvania.

NATIONAL SAFETY CONGRESS

The American Optometric Association was represented at the National Safety Congress in Chicago by Dr. F. W. Staubach, a member of the Committee on Occupational Vision, and by Miss Dorothy Nuttall, Executive Secretary of the Public Health Bureau.

These representatives of the association extended to the National Safety Council the fullest possible aid in promoting a knowledge of vision in relation to safety. America's appalling accident toll is too frequently due to visual deficiencies. It is the hope of the association that

by co-operating with the National Safety Council in reducing this toll that the attention of the American people may be brought to bear upon this essential factor to safety.

BETTER VISION INSTITUTE MEETING

The Third Quarterly Meeting of the Better Vision Institute was held at the Park Lane Hotel, New York, on Friday, September 27th. About 60 persons attended—the Board of Directors and several guests.

Mr. E. E. Williams, Treasurer, read the Treasurer's report. Mr. Julian, President, mentioned several of the Institute activities. Excellent returns are being received on press releases regarding vision, which the Institute sends out regularly. Articles on the subject of eyes and eyewear will appear in several magazines, among them Liberty, Science Digest, Secrets, and Seventeen. The pictorial mats which the Institute produced on the subject of Highway Safety are in large demand. BVI material is being utilized widely in effective displays by professional groups.

Two new proposed factory posters were shown, as well as two finished "mats" for member use. Twenty new "Classics" covering different aspects of eyes and seeing are in course of preparation; and while written in a style easily readable by the layman, will carry accurate scientific information. Available soon to Institute members will be a series of newspaper "columns" on mat form. These are completely professional in subject and character, and provide for a small by-line by the Institute member publishing them.

Forty-eight programs in the Institute radio series, "Eyes on the Future," have been completed, and twelve more are in course of preparation. These will feature Dr. Selig Hecht, eminent scientist; Stella Center, authority on reading; and Eddie Senz, noted makeup artist. Famous singers on these programs are Barry Wood, Margaret Daum, and Jane Pickens.

National ads in preparation for the balance of 1946 and the early part of 1947 were shown, as well as a new series of ads scheduled for appearance in the professional magazines.

MOBILE EYE CLINIC IN NEW JERSEY

America's first mobile clinic for providing eye care in remote areas was dedicated at Trenton, New Jersey, October 12th, in ceremonies at the state capital.

Taking part in the unveiling of the nation's first eye clinic on

wheels was Gov. Walter E. Edge, of New Jersey, members of the New Jersey Commission for the Blind, and state public health and welfare officials. Dedication of the two and one-half-ton unit, sponsored by the New Jersey commission which has pioneered in bringing eye care to the needy in sparsely settled areas of the state, was held on the capital grounds at noon.

Nineteen feet long and more than six feet wide, the unit contains Bausch & Lomb Optical Company equipment, including a refracting chair, refractor, slit lamp, and such diagnostic equipment as retinoscopes and ophthalmoscopes found in the unit's modern eye examining room.

The Rochester, New York, optical firm planned the interior layout so that the many delicate instruments used in eye examinations could be safely transported to rural areas for immediate clinical diagnosis of eye conditions.

Diagnosis of eye diseases, minor treatments and operations along with examination of eyes for glasses can thus be made readily available in all areas.

Somewhat similar to the mobile optical units used overseas during the war by the armed forces, the rolling eye clinic will provide a public health service rivaling that of the mobile hospital clinics now in use in the south.

CONTACT LENS FITTING COURSE BY BEACHER

A group instruction course on contact lens fitting is scheduled as a seminar for December 15, 16, 17 and 18, 1946, at the Newark, New Jersey, office of Dr. L. Lester Beacher, 94 Clinton Ave. The attendance will be limited and optometrists wishing to attend should register at once.

A. O. A. PICKS ATLANTIC CITY FOR FIFTIETH CONGRESS

The Fiftieth Annual Congress of the American Optometric Association will be held at Atlantic City, New Jersey, June 22, 23, 24 and 25, 1947. Drs. G. L. Brown, J. J. Brown, E. L. Ridgeway and A. F. Fischer will serve as Chairmen of the general arrangements committee.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

1. OCULAR REFRACTION

THE CONTACT LENS IN CORNEAL IRREGULARITIES. S. W. Silverstein, The Columbia Optometrist, 1945, 19, May, page 2.

The author mentions various uses of contact lenses and points out that these lenses may be used to advantage in cases of long standing opaque corneas where the sight in the affected eye is lost. In these cases the contact lens is not of the regular type used to improve vision but is rather a colored contact lens with a painted pupil. The contact lens in these cases being used to improve the appearance of the patient by covering the badly necrotic corneal opacities. A. V. H.

2. PHYSIOLOGICAL OPTICS AND COLOR VISION

NIGHT VISION AND DARK ADAPTATION. K. D. Foggitt. Transactions of the Middle East Optical Practitioners Group, Cairo, Egypt. Vol. 1, 1945.

The lecturer began by outlining the histology and physiology of the retina, and then proceeded to describe the rod and cone receptors in greater detail.

Foggitt gave a detailed explanation of how the eye works under its condition of maximum sensitivity, i.e., when fully dark-adapted. The pupil is then dilated to the full, and has an effect equivalent to an f. 2. lens, compared to f. 8. in average daylight.

Diagrams were presented to illustrate the distribution of the rod and cone elements in the retina, and it was pointed out that the rods which are responsible for scotopic vision are absent from the macular area, which is thus almost blind in low illuminations. It was also explained how processes from the pigment epithelium cells push forward round the rods during photopic vision with the believed purpose of protecting the rods from excess light.

The function of the rods and cones was shown to depend upon the diffusion of essential substances, including vitamin A and oxygen, from the choroidal blood-vessels, and not from the retinal vessels. The

formation and regeneration of rhodopsin within the rod-cells, after its being bleached by light, is made possible by the diffusion, in both directions, between retina and choroid, of metabolic substances. Local disease in the eye may retard or stop this activity, whereon adaptation is slowed, and night vision diminished. Lack of vitamin A is the best known, but one of the rare causes of defective night vision. Certain diseases of the liver may produce a similar condition, and in these cases the rods are unable to replace their rhodopsin owing to lack of vitamin A.

The great majority of people complaining of night blindness during the war have been suffering from "hysterical" night blindness which is not due to any physical disability. In cases of simple glaucoma, optic atrophy, extensive uveitis, retinitis pigmentosa, and in individuals with "pin point" pupils where the amount of light entering the eye is reduced, night vision is definitely impaired and these people suffer a disability in darkness, amounting in some cases to total blindness.

Methods of measuring the absolute threshold of illumination and the specific threshold for color were described, and it was mentioned that while in photopic vision the yellow line of the spectrum is the brightest, in scotopic vision the green portion of the spectral band is seen brightest, although, of course, the spectrum appears gray in scotopic vision.

Color vision is exclusively the function of the cones, and thus when illumination is reduced to the point where the cones cease to be able to function, color vision ceases and objects are seen in black and white. This point is the specific threshold of illumination for the color in questoin. A full understanding of this point is essential for proper appreciation of perimetry where different colored targets are used under varying conditions.

An instrument for measuring night vision was then demonstrated. Its essential part consists of five opal plates fixed vertically on a turntable round a source of light in such a manner that each plate is a different distance from the light. A "V" in different positions is inscribed in black on each plate. A rheostatic control enables the illumination to be varied, and a clockwork mechanism turns the table round in such a manner that the plates are presented in turn to the observer, who is allowed 10 seconds in each position.

Five people can be examined at the same time on this instrument, and they are first dark-adapted for 20 minutes and wear dark goggles during the actual test. They are seated at exactly one metre from the instrument and the test is carried out in complete darkness. As the table turns, the examinees write down on a special card the direction in which each "V" is pointing. A score of 5/5 is excellent, 3/5 is regarded as average, and if any of the 5 plates are recognized correctly the examinee's night vision is satisfactory for ordinary purposes. T. O. B.